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Bioefficacy of tolfenpyrad 15 EC against hopper complex in mango

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ABSTRACT : Field experiments were conducted to study the bio-efficacy of new insecticide tolfenpyrad in comparison to neonicotinoid insecticides against hopper complex in mango infesting mango c.v Dashehari at Agriculture Research Station of Borwat Farm, Banswara during 2011 and 2012. All the treatments were significantly superior over untreated check. Results of the experiment indicated that the maximum reduction in hopper population was observed after third, seventh and tenth days after sprays with tolfenpyrad @ 150 and 125 g. a.i/ha. These are significantly higher over Imidacloprid 17.8% SL @ 22.25 g a.i./ha, thiomethoxam 25% WG @ 25 g a.i./ha and Tolfenpyrad 15 EC @ 100 g a.i./ha. Tolfenpyrad 15 EC realized higher yield at its higher dose of 150 and 125 g a.i./ha when compare to untreated control.

Keywords : Mango, neonicotinoid, tolfenpyrad, hopper

INTRODUCTION

Mango (*Mangifera indica* Linn.) is the most important commercial fruit of India and is known as "King of fruits". Production and quality of mango are mainly hampered by the incidence of about 400 insect pests (Devi Thangam *et al.*, 2013). Among the mango pests, mango hoppers are most serious (Verghese, 2000) and widespread pests throughout the country. *Amritodus atkinsoni* (Lethierry), *Idioscopus clypealis* (Lethierry) *I. niveosparsus* (Lethierry) and *I. nitidulus* (Walker), are serious pests of mango at flowering and fruiting stages and could cause yield loss up to 100% (Rahman and Kuldeep, 2007; Prabhakara *et al.*, 2011). The hoppers are active during flowering period and in the remaining period, they remain confined to the under surface of leaves, situated in dark and moist areas of the tree.

Large number of nymphs and adults of the hoppers puncture and suck the sap from tender shoots, inflorescence and leaves of mango crop, which cause non-setting of flowers and dropping of immature fruits, thereby reducing the yield. Hoppers also excrete honey dew which encourages the development of sooty mould and this black coating interferes with the normal photosynthetic activity of the plant. Though several natural enemies have been reported on mango hoppers, chemical control remains the widely followed means of hopper management. Insecticides like imidacloprid, lambda cyalothrin or azadiractin have been recommended (Verghese, 2000). The extensive and indiscriminate use of pesticides for hoppers in mango has led to several problems like resurgence of secondary pests, health hazards and pesticide residues on fruit. Hence there is a need to evaluate newer molecules. The objective of the present investigation was to test the efficacy of newer insecticide molecule having different mode of action for the management of hoppers in mango.

MATERIALS AND METHODS

Field studies were conducted during 2011 and 2012 at Agriculture Research Station, Borwat Farm, Banswara to evaluate the bioefficacy of tolfenpyrad 15 EC on mango hoppers. The experiment was laid out in a 12 year old orchard with cultivar 'Dashehari' in Randomized Block Design with four replications. The treatments comprising of insecticides, tolfenpyrad 15 EC at three different doses (100, 125 and 150 g a.i./ha), imidacloprid 17.8% SL @ 22.25 g a.i./ha and thiomethoxam 25% WG @ 25 g a.i./ha. The control plot was sprayed with water only. The first spray was given at panicle stage then followed by the second one after 15 days. The observations on hoppers population were taken on five panicles per tree and data were collected on pre-spray and the post treatment counts on absolute population of number of hoppers/five panicles per tree at 3rd,7th and 10th day after each spray. The data obtained from the field experiments were subjected to square root transformation and subjected to ANOVA analysis. The fruit yield per tree was recorded and converted into hectare basis at each harvest and data were subjected to statistical analysis.

Table 1. Efficacy of different insecticides against hoppers on mango (2011)

Treatment	Mean hopper population/5 panicles							
	1st Spray				2nd Spray			
	PT	3DAS	7DAS	10DAS	PT	3DAS	7DAS	10DAS
Tolfenpyrad 15% EC @ 100 g a.i./ha	15.60 (3.95)	9.17 (3.03)	5.73 (2.39)	4.33 (2.08)	8.67 (2.94)	4.27 (2.06)	3.77 (1.94)	3.53 (1.88)
Tolfenpyrad 15% EC @125 g a.i./ha	14.57 (3.81)	7.07 (2.66)	3.17 (1.78)	1.73 (1.31)	5.73 (2.39)	1.63 (1.27)	1.27 (1.11)	1.03 (1.01)
Tolfenpyrad 15% EC @150g a.i./ha	15.37 (3.92)	6.63 (2.57)	2.93 (1.71)	1.27 (1.13)	4.73 (2.17)	1.47 (1.21)	1.13 (1.06)	0.83 (0.91)
Imidacloprid 17.8% SL @ 22.5 g a.i./ha	16.03 (4.00)	8.43 (2.90)	4.03 (2.00)	2.03 (1.41)	5.47 (2.34)	2.63 (1.62)	2.13 (1.46)	2.20 (1.48)
Thiamethoxam 25% WG @ 25g a.i./ha	15.03 (3.87)	8.77 (2.95)	4.37 (2.06)	4.23 (2.05)	5.93 (2.43)	3.17 (1.77)	2.37 (1.53)	2.43 (1.56)
Control	15.53 (3.94)	19.07 (4.37)	15.93 (3.98)	17.13 (4.13)	23.27 (4.82)	18.57 (4.31)	18.07 (4.25)	17.57 (4.19)
CD (p = 0.05)	NS	0.274	0.378	0.280	0.209	0.236	0.209	0.133

PT-pre-treatment; NS – Non significant Figures in Parenthesis represent square root transformation values

Table 2. Efficacy of different insecticides against hoppers on mango (2012)

Treatment	Mean hopper population/5 panicles							
	1st Spray				2nd Spray			
	PT	3DAS	7DAS	10DAS	PT	3DAS	7DAS	10DAS
Tolfenpyrad 15% EC @ 100 g a.i./ha	20.03 (4.47)	9.27 (3.04)	6.27 (2.49)	4.27 (2.05)	8.67 (2.94)	5.67 (2.38)	4.87 (2.20)	3.97 (1.99)
Tolfenpyrad 15% EC @125 g a.i./ha	19.07 (4.37)	6.33 (2.51)	3.33 (1.82)	1.33 (1.12)	5.73 (2.39)	2.37 (1.53)	1.40 (1.18)	1.13 (1.06)
Tolfenpyrad 15% EC @150g a.i./ha	19.83 (4.45)	5.53 (2.35)	2.53 (1.58)	0.93 (0.95)	4.73 (2.17)	1.87 (1.37)	1.07 (1.03)	0.90 (0.95)
Imidacloprid 17.8% SL @ 22.5 g a.i./ha	20.57 (4.53)	6.77 (2.60)	3.77 (1.93)	1.77 (1.28)	5.47 (2.34)	2.53 (1.59)	1.67 (1.29)	1.67 (1.29)
Thiamethoxam 25% WG @ 25g a.i./ha	20.73 (4.55)	7.17 (2.67)	4.17 (2.04)	2.17 (1.46)	5.93 (2.43)	3.33 (1.82)	2.37 (1.54)	2.77 (1.66)
Control	19.33 (4.40)	22.20 (4.71)	19.20 (4.38)	20.13 (4.48)	23.27 (4.82)	21.13 (4.60)	23.10 (4.81)	24.73 (4.97)
CD (p = 0.05)	NS	0.293	0.387	0.630	0.256	0.208	0.201	0.210

PT-pre-treatment; NS – Non significant; Figures in Parenthesis represent square root transformation values

RESULTS AND DISCUSSION

The results (Tables 1 & 2) indicated significant differences among all the treatments in both the years of study. Newer insecticide molecule, tolfenpyrad 15 EC recorded minimum population of hoppers and maximum yield in the form of fruit yield. It is evident from data in Table 1 that the pre-count of hopper population was non-significant showing even distribution of hoppers before spraying. On third day of observation, all the treatments were significantly reduced the population of hopper over untreated control. Application of Tolfenpyrad 15 EC @ 150 g a.i./ha recorded lowest population of mango hopper 6.63, 2.93 and 1.27 on 3rd,7th and 10th days after first spray, respectively and significantly higher over Imidacloprid 17.8% SL @ 22.25 g a.i./ha, thiomethoxam 25% WG @ 25 g a.i./ha and Tolfenpyrad 15 EC @ 100 g a.i./ha and at par with Tolfenpyrad 15 EC @ 125 g a.i./ha. The same trend was observed after second spray from 3 to 15 days after spray where the lowest population of hopper was recorded in the treatment Tolfenpyrad 15 EC @ 150 g a.i./ha and at par with Tolfenpyrad 15 EC @ 125 g a.i./ha as 1.63, 1.27 and 1.03 on 3rd,7th and 10th days after second spray, respectively.

In the second year of study (Table 2), the mean population of hopper ranged from 19.07 to 20.73 per 5 panicles during the pre-treatment period. Three days after application all the treatments were significantly reduced the population of hopper over untreated control. Spraying with Tolfenpyrad 15 EC @ 150 g a.i./ha recorded lowest population of mango hopper (5.53, 2.53 and 0.93 at 3rd,7th and 10th days at first spray, respectively) and significantly higher over Imidacloprid 17.8% SL @ 22.25 g a.i./ha, thiomethoxam 25% WG @ 25 g a.i./ha and Tolfenpyrad 15 EC @ 100 g a.i./ha and at par with Tolfenpyrad 15 EC @ 125 g a.i./ha. The same trend was observed after second spray from 3 to 10 days after spray where the lowest population of hopper was recorded in the treatment Tolfenpyrad 15 EC @ 150 g a.i./ha as 1.87, 1.07 and 0.90 on 3rd,7th and 10th days after spray, respectively. The next lowest population of hopper was recorded in the treatment Tolfenpyrad 15 EC @ 125 g a.i./ha as 2.37, 1.40 and 1.13 on 3rd,7th and 10th days after second spray, respectively.

Table 3. Effect of different treatments on mango fruit yield

Treatment	Mean fruit yield (q/ha)	
	2011	2012
Tolfenpyrad 15% EC @ 100 g a.i./ha	90.67	70.67
Tolfenpyrad 15% EC @125 g a.i./ha	115.33	90.00
Tolfenpyrad 15% EC @150g a.i./ha	120.33	96.67
Imidacloprid 17.8% SL @ 22.5 g a.i./ha	100.00	79.33
Thiamethoxam 25% WG @ 25g a.i./ha	95.33	75.00
Control	68.33	61.00
CD (p = 0.05)	11.48	9.52

It is seen from the Table 3 that during 2011, treatment, tolfenpyrad 15 EC @ 150 g a.i./ha recorded maximum fruit yield (120.33 qt/ha) followed by its lower dose 125 g a.i./ha (115.33 qt/ha), whereas in control the yield was only 68.33 qt/ha. The next treatments, imidacloprid 17.8% SL @ 22.25 g a.i./ha, thiomethoxam 25% WG @ 25 g a.i./ha and tolfenpyrad 15 EC @ 100 g a.i./ha also recorded higher fruit yield and at par with each other treatments. Similar trend was also noticed in 2012 (Table 3). Treatment, tolfenpyrad 15 EC realized yield of 96.67 and 90.00 qt/ha at its higher dose of 150 and 125 g a.i./ha, respectively.

As per the previous studies, the resurgence of hoppers in mango due to the continuous use of synthetic pyrethroids has been reported. Several authors used new group of neonicotinoid chemicals *viz*., imidacloprid and thiomethoxam for the management of hoppers (Verghese, 2000; Patel *et al*., 2003; Sushil Kumar *et al*., 2005; Samanta *et al*., 2009; Mohinder *et al*., 2010; Ray *et al*., 2011; Prabhakara *et al*., 2011). The new generation chemical used in this study belongs to group 21 in the IRAC (insecticide resistance action committee) mode of action classification and offer unique mode of action. Tolfenpyrad (4-chloro-3-ethyl-methyl-N-[4-(p-tolyloxy) benzyl] pyrazole-5-carboxamide) is a novel molecule belonging to pyrazole class of insecticides. The insecticide acts mainly through contact inhibiting respiration of the target pest and resulting in rapid insecticidal responses including cessation of movement and feeding, lack of fecundity and eventful death of pests. Field test with different doses ranging from 125 to 150g a.i./ha, the Tolfenpyrad effectively controlled sucking pest complex in okra and cotton, thrips and capsule borers of chilli and onion thrips (Mandal, 2013).

Several authors have reported efficacy of tolfenpyrad 15% EC in managing sucking pest complex in different crops. Bajpai and Singh (2010) reported tolfenpyrad 15EC @ 150g a.i./ha was very effective against sucking pests of okra. Similarly, Kalyan *et al* (2011) studied the bioefficacy of tolfenpyrad 15% EC against sucking pests of cotton. They observed that the doses of tolfenpyrad 15% EC at 125 and 150g a.i./ha were significantly

superior to imidacloprid 17.8 SL and thiomethoxam 25 WG in suppressing the population of sucking pests in cotton. Maximum reduction in aphid population after third, seventh and fourteenth days after sprays ranged from 24.45 to 97.14% in tolfenpyrad @ 150 and 125 g. a.i/ha (Bajpai *et al*., 2013).

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